APPLICATION

OF

WILLIAM P. YOUNG

FOR

UNITED STATES LETTERS PATENT

ON

LASER ONYCHECTOMY BY RESECTION OF THE REDUNDANT EPITHELIUM OF THE UNGUAL CREST

(a) TITLE: LASER ONYCHECTOMY BY RESECTION OF THE REDUNDANT EPITHELIUM OF THE UNGUAL CREST

(b) CROSS-REFERENCES TO RELATED APPLICATIONS

This application claims the benefit of U.S. Provisional Application No. 60/176,965 filed January 19, 2000.

(c) STATEMENT REGARDING FEDERALLY-SPONSORED RESEARCH AND DEVELOPMENT

(Not Applicable)

(d) Reference to a "Microfiche appendix"

(Not Applicable)

(e) BACKGROUND OF THE INVENTION

1. Field Of The Invention

This invention relates generally to animal surgical procedures, and more particularly to a process for removing one or more claws of domesticated cats.

2. Description Of The Related Art

For the purpose of medical necessity, due to trauma or infection, or because of owner election, the claws of felines, and most commonly household cats, are frequently removed. It is the second most performed elective procedure next to sterilization and practiced by veterinarians worldwide.

Onychectomy is the disarticulation and removal of the third phalanx in cats. Conventionally, onychectomy has been performed using mechanical cutting instruments, such as scalpels and clippers, to sever the skin, ligaments, tendons, and synovium at the PII-PIII joint. The instruments mechanically sever all of the tissue along a transverse plane passing between the second and third phalanges (PII-PIII) in the manner of a

guillotine. Conventional onychectomy procedures cause complications due to the nature of the instruments used. The complications are hemorrhage, pain, swelling and tissue deficit due to removal of PIII. The tissue deficit is generally closed with sutures or tissue adhesives.

The complications of hemorrhage, pain and swelling have been reduced with the introduction of the CO_2 surgical laser. Exposure of the laser beam to tissue excites water molecules within tissue cells. The energy of the laser vaporizes the water in the cells and thereby ruptures the cells. The laser causes minimal damage to adjacent cells due to the fact that the beam is so narrow. Vaporization of cells coagulates small blood vessels and resects nerves with minimal trauma.

Although laser onychectomy reduces hemorrhaging, pain and swelling, traditional laser techniques retain the guillotine-oriented cutting path, thereby resulting in tissue deficit at the site where the third phalanx is removed. This deficit necessitates epidermal closure to cover the surgical site. As previously stated, this involves suturing the epidermis or closing it with

tissue adhesive. Frequently no closure is used and the deficit closes by secondary intention resulting in delayed healing and the increased possibility of infection.

(f) BRIEF SUMMARY OF THE INVENTION

The invention is a feline onychectomy surgical method using a laser cutting instrument. The method removes the third phalanx with reduced bleeding, pain and swelling by strict anatomical dissection of only connective tissue structures. Most importantly, the technique leaves a substantial portion of tissue to cover the exposed tip of the second phalanx. This eliminates the need for surgical closure of the remaining epidermis and decreases the incidence of infection.

The method includes forming a first circumferential incision with the laser in the epidermis at the edge of the ungual crest of the feline's claw. This first incision severs the most distal portion of the epidermis from the underlying fascia of the ungual crest. After

the first incision, the surgeon applies cranial traction to the epidermis severed from the ungual crest to displace the distal edge of the epidermis cranially.

A second circumferential incision is preferably formed in the epidermis about 3 millimeters cranial to the first circumferential incision. This distance can vary, depending upon the size of the feline, but 3 millimeters is common for the domesticated cat. This second incision extends deeper into the subcutaneous fascia and further facilitates the cranial displacement of the epidermis from the ungual crest.

After making the second incision, the epidermis is pushed cranially and the extensor tendon is incised near its insertion on the ungual crest. This incision is formed by directing the laser beam in a substantially palmar direction when a laser beam source is positioned substantially dorsally of the extensor tendon. Next, the synovium of the PII-PIII joint is incised and traction is applied to the claw in the palmar direction to begin to disarticulate the PII-PIII joint and allow access to the medial and lateral collateral ligaments.

The medial and lateral collateral ligaments are ablated by directing the laser beam in a substantially palmar direction when the laser source is positioned substantially dorsally of the ligaments. This allows further disarticulation of the PII-PIII joint and access to the digital flexor tendon by palmar rotation of PIII. Next, the digital flexor tendon is incised by directing the laser beam in a substantially palmar direction when the laser source is positioned substantially dorsally of the flexor tendon. This allows for extreme palmar rotation of PIII and reveals the subcutaneous tissues of the pad.

Finally, the subcutaneous tissues of the pad of the second phalanx are incised by directing the laser beam in a substantially palmar direction when the laser source is positioned substantially dorsally of the subcutaneous tissues of the pad of the second phalanx.

The invention involves resection of the redundant epidermis to allow complete anatomical dissection and removal of the claw from a strictly cranio-dorsal approach. By operating only from the dorsal part of the paw and anatomically dissecting PIII by vaporizing only

the connective tissue structures, trauma to the surrounding tissue is minimized. The preserved epidermis of the ungual crest that is normally discarded by all other techniques is retained to cover virtually all of the surgical site.

Of course, this surgical process will be recognized by a person having ordinary skill in the art to be adaptable to other animals, specifically dogs.

(g) BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

Fig. 1 is a schematic side view illustrating the normal digit of the domesticated cat.

Fig. 2 is a schematic illustration of the first and second circumferential incisions of the epidermis of the ungual crest.

Fig. 3 is a schematic illustration of the incision of the digital extensor tendon side view.

Fig. 4 is a schematic illustration of incision of the joint capsule of PII-PIII, palmar disarticulation, and direction of the ablation of the collateral ligaments.

Fig. 5 is a schematic side view illustrating the palmar disarticulation of PIII and the incision of the digital flexor tendon. It also illustrates the plane of dissection of the subcutaneous tissues from the pad of PII.

Fig. 6 is a schematic side view illustrating the claw after it has been removed from the second phalanx.

Fig. 7 is a schematic side view illustrating the remaining portion of the cat's appendage with the redundant epithelium pushed back over the declaw site.

Fig. 8 is a photographic illustration of a prior art onychectomy process utilizing a guillotine method of onychectomy by utilization of Resco nail trimmers.

Fig. 9 is a photographic illustration of a prior art onychectomy process involving closure of the epidermis after the mechanical declaw of Fig. 8.

Fig. 10 is a photographic illustration of the claw after the first circumferential incision in the epidermis at the edge of the ungual crest.

Fig. 11 is a photographic illustration of the claw after the first circumferential incision in the epidermis at the edge of the ungual crest.

Fig. 12 is a photographic illustration of the claw after the second circumferential incision in the epidermis about 3 millimeters cranial to the first circumferential incision.

Fig. 13 is a photographic illustration of the claw after the second circumferential incision in the epidermis about 3 millimeters cranial to the first circumferential incision.

Fig. 14 is a photographic illustration of the claw after the second circumferential incision in the epidermis about 3 millimeters cranial to the first circumferential incision. The redundant epidermis is pushed cranially to the incisions.

Fig. 15 is a photographic illustration of the claw after the second circumferential incision in the epidermis about 3 millimeters cranial to the first circumferential incision. The extensor tendon is exposed.

Fig. 16 is a photographic illustration of the incision of the extensor tendon.

Fig. 17 is a photographic illustration of the synovium of the PII-PIII joint.

Fig. 18 is a photographic illustration of the medial and lateral collateral ligaments.

Fig. 19 is a photographic illustration of the plane of incisions of the medial and lateral collateral ligaments.

Fig. 20 is a photographic illustration of the incising of the digital flexor tendon.

Fig. 21 is a photographic illustration of the extreme disarticulation of the PII-PIII joint prior to incising the subcutaneous tissues of the pad.

Fig. 22 is a photographic illustration of the incising of the subcutaneous tissues of the pad of the second phalanx.

Fig. 23 is a photographic illustration of the declaw site with the redundant epithelium covering the onychectomy site.

Fig. 24 is a photographic illustration of the declaw site with the redundant epithelium covering the onychectomy site.

In describing the preferred embodiment of the invention which is illustrated in the drawings, specific terminology will be resorted to for the sake of clarity.

However, it is not intended that the invention be limited to the specific term so selected and it is to be understood that each specific term includes all technical equivalents which operate in a similar manner to accomplish a similar purpose. For example, the word connected or term similar thereto are often used. They are not limited to direct connection, but include connection through other elements where such connection is recognized as being equivalent by those skilled in the art.

(h) DETAILED DESCRIPTION OF THE INVENTION

The process of the present invention proceeds as illustrated in the Figures. Fig. 1 shows a feline appendage 10, including the second phalanx 12 and the third phalanx 14 with the ungual crest 15. The phalanges 12 and 14 are connected by the extensor tendon 16, the flexor tendon 18, the collateral ligaments 20 and 22, the epithelium 24 and the pad 26. The synovium 28 is positioned in the joint between the second and third phalanges 12 and 14. It also connects the phalanges together.

A preliminary step to this procedure is the cleaning of the area to be operated upon. The patient should be premedicated and anesthetized in accordance with aseptic surgical protocol. The hair need not be clipped because the area is normally devoid of hair. The patient is prepped in lateral recumbancy and draped. A forcep is placed upon the claw that is to be removed.

There are four major steps to the process. They are (1) resection of the redundant tissue of the ungual crest; (2) incision of the extensor tendon and the synovium; (3) ablation of the collateral ligaments; and (4) incision of the flexor tendon and dissection of the subcutaneous tissue of the pad. These steps are described below in the preferred order in which they are taken.

The preferred method includes the positioning of the laser source dorsally of the paw and pointed in a palmar direction. All incisions are made with a laser, such as a CO_2 laser set at 4 to 6 watts, and preferably a continuous wave form. The laser source is commonly an elongated handpiece but could include any structure from which the beam is directed just prior to striking

tissue. The laser source is positioned in a substantially dorsal position and pointed in a palmar direction. It will be apparent that momentary movement of the laser source from the dorsal position may be necessary during cutting to avoid directing the beam onto tissue that should not be cut. However, all contemplated applications of the laser's beam are in a palmar direction from a dorsal position.

The first major step in the process is the formation of an incision in the redundant epidermis of the ungual crest 15 of the claw along the line A-A of Fig. 2. This incision is made near the most distal edge of the epidermis and extends circumferentially around the claw to sever the epidermis from the ungual crest 15. The distal edge of the severed epidermis is moved cranially by gentle traction applied in the direction of the arrow, T.

The traction in the direction T causes the epithelium to release from its distal attachment and permits a second circumferential incision of the redundant epithelium approximately 3 millimeters cranial from the first incision along the line B-B. This second

incision allows slightly deeper subcutaneous fascia to be moved cranially over the ungual crest as well.

The tissue pushed cranially will later form a covering for the opening formed by the removal of the claw. This thereby avoids the problem of tissue deficit inherent in all known onychectomy procedures.

The position of the second incision 3 millimeters cranial of the first incision is based upon the average size of the household cat. For smaller animals the distance will be smaller, and for larger animals the distance will be larger.

Once the epidermis is pushed cranially, the second major step of the process can be taken. In the second step, as shown in Fig. 3, the extensor tendon 16 is resected at its insertion on the ungual crest 15 by the dorsally-positioned laser source 30 pointed in a palmar direction. The redundant epithelium is kept pushed cranially over the ungual crest and the laser completely severs the tendon 16 from the ungual crest.

Once the extensor tendon 16 is severed, traction is applied to the claw in a palmar direction by the forcep, causing the joint to become distracted. Care is taken

to avoid applying too much traction, which will cause bleeding due to the tissue tearing rather than being incised. In the same step, using a slightly extended incision, the synovium 28 of PII-PIII is incised. Further traction applied to the claw in a palmar direction will permit further disarticulation of the joint as shown in Fig. 4, thereby exposing the collateral ligaments 20 and 22.

The third major step, as shown in Fig. 4, is to ablate the medial and lateral collateral ligaments 20 and 22. The laser source 30 in the dorsal position of the limb 10 is directed in a palmar direction onto the ligaments 20 and 22 in a direct "head on" fashion. The ligaments 20 and 22 are vaporized until they are completely severed. Gentle traction in a palmar direction is applied to disarticulate the PII-PIII joint even further to the position shown in Fig. 5.

The fourth major step is the incision of the digital flexor tendon 18 and the dissection of the subcutaneous tissues of the pad 28 along the line 29 from the third phalanx 14. The third phalanx 14 is rotated in an extreme palmar direction, making the

flexor tendon 18 visible and accessible to the laser's beam from a dorsal position. The laser is pointed in a palmar direction, and as the flexor tendon 18 is vaporized, traction in a palmar direction causes continued disarticulation as shown in Fig. 5. Once the flexor tendon 18 is completely severed, the subcutaneous tissue of the pad 28 of the third phalanx 14 is dissected as shown in Fig. 6.

During the fourth major step, the palmar surface of the third phalanx is exposed dorsally due to the extreme palmar rotation, permitting palmar attachments of the subcutaneous tissue to be incised from a dorsal position. This allows for easy dissection by continued palmar rotation. The laser beam is kept close to the surface of the third phalanx 14 to prevent any significant damage to the redundant epithelium.

Once the claw or claws have been removed, the surgeon should inspect the site and clean it as necessary. The redundant epithelium is then pushed over the declaw site to cover and protect it as shown in Fig. 7. After the site is healed, the epithelium that was preserved during surgery provides a significantly

improved declaw site over those that remain after conventional onychectomy procedures.

While certain preferred embodiments of the present invention have been disclosed in detail, it is to be understood that various modifications may be adopted without departing from the spirit of the invention or scope of the following claims.